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(54) Title of the Invention: **Manufacturing Method For Nonwoven Carpet**

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### **Brief Description of the Drawings**

Fig. 1 is a partial cross-sectional side view showing an example of the device for manufacturing nonwoven carpet according to the method of the present invention, and Fig. 2 is an enlarged cross-sectional view of nonwoven carpet manufactured according to the method of the present invention.

### **Detailed Description of the Invention**

The present invention relates to a manufacturing method for nonwoven carpet comprising a three layer structure of needle-punch nonwoven fabric, film, and foam sheet.

There are mats wherein a fiber bed is placed on a conventional synthetic resin foam and both are joined by needle-punching, or simple mats wherein a urethane foam and jacquard fabric based on condenser yarn or a throstle-spun yarn are bonded together. However, the former method has a drawback whereby its moisture resistance and water resistance are inferior because needle-punching causes the fibers to pass completely through the foam, and the foam easily hardens because the fibers are implanted therein. In addition, foam with relatively small bubbles must be used to firmly hold the fibers, so it is difficult to obtain adequate elasticity in response to foot pressure. It has further drawbacks whereby the foam does not adhere to the floor, easily slips, and suffers from poor stability because the needle-punched fiber tends to appear on the reverse side of the foam as fluff. The elasticity of the foam is lost due to repeated walking load during use; and there is the possibility that the foam may split primarily along the fiber-implanted portions, causing the fiber layer and the foam to separate.

The latter mat has drawbacks in that urethane foam is the primary thickness component, large dents form in the mat and the hardness of the floor is felt when the mat is stepped on, and because the mat returns to its former shape when the foot is removed, walking on the mat creates an uncomfortable sensation. Curving action is further repeatedly applied to bonded portions by walking pressure, and because component force is directly applied to the adhesion surface in the forward and reverse directions due to walking, the bonded portions easily separate, and the stability is poor because the edges easily become rounded.

An object of the present invention is to eliminate the conventional drawbacks described above and to inexpensively manufacture an excellent nonwoven carpet that is pleasant to use and has good morphological stability by placing and bonding a synthetic resin film between a needle-punch nonwoven fabric and a foam sheet.

The manufacturing method of the present invention is described below with reference to the diagrams. Preferably, the needle-punch nonwoven fabric 1 is formed by needle-punching a polypropylene fiber web at a punching number of about 120 to 150 punches/cm<sup>2</sup>, has needle holes 2 formed by such needle-punching on the surface, possesses a reasonable firmness, and has adequate shape retention characteristics even if thin. Synthetic resin film 3, which is pressure bonded to this needle-punch nonwoven fabric 1, is formed as one sheet of film by the T-die

method with the aid of the apparatus shown in Fig. 1. The forming conditions for the synthetic resin film 3 in Fig. 1 are explained below. Pellet-shaped resin material 4 is loaded into the melting extruder 6 through the lower portion of the hopper 5. A screw 8 that is rotated with the aid of a suitable power source 7 is disposed in this extruder 6. The loaded resin material 4 is melted by heating inside the extruder 6 and is extruded with the screw 8 through a slit 9, resulting in the film 3, but the film 3 emerging to the exterior through the slit 9 remains in a hot and soft state. Polyethylene, a polyethylene/vinyl acetate copolymer, polypropylene, polyester, or other resin may be used as the resin material 4, but polyethylene is particularly preferable since it melts at a low temperature and is much more inexpensive than other resin materials because it is manufactured in a pellet form and because the resin material used in pellet form in the T-die method does not need to be formed into pellets from powder as with other resins. The hot, soft synthetic resin film 3 formed in this manner is layered, processed, and bonded as a foundation fabric between the needle-punch nonwoven fabric 1 and the foam sheet 10. The heated synthetic resin film 3 immediately following extrusion must be used in a state in which it is heated to a temperature equal to or greater than that at which the fluff of the needle-punch nonwoven fabric 1 melts and the foam sheet 10 exhibits viscosity. In other words, the film 3 is preferably used in a heated state at a temperature of 200°C or more because when the fiber composition of the needle-punch nonwoven fabric 1 is a polypropylene fiber, melting occurs at about 160 to 170°C, and when the foam sheet 10 is urethane foam, melting occurs at 192 to 194°C. The foam sheet 10 in Fig. 1 is laid over the film 3 with the press roll 11, fed together with the needle-punch nonwoven fabric 12 between the pressing rollers 12 and 12, and formed into a roll 14 as a three-layered nonwoven carpet base 13. This nonwoven carpet base 13 is a result of bonding the synthetic resin film 3 interposed between the needle-punch nonwoven fabric 1 and the foam sheet 10 under pressure, but because the fluff of the nonwoven carpet 1 melts into the film 3, and a portion of the compositional resin of the film 3 is pressed into the needle holes 2 of the nonwoven fabric 1 in the bonding surface of the nonwoven fabric 1 and the film 3, the nonwoven fabric 1 and the film 3 are firmly bonded. Both the bonding surface of the film 3 and the foam sheet 10 are firmly bonded because the foam sheet 10 is kept viscous by the heated film 3, and a portion of the compositional resin of the film 3 is forced into the exposed bubbles 15 of the foam sheet 10 by pressure. The surface of the film 3 at this time firmly adheres to the nonwoven fabric 1 and the foam sheet 10, and serves as a foundation fabric that

maintains the form of film. Because the foam sheet 10 uses a foam elastic body having a plurality of bubbles in the interior of urethane foam or other material, the product is provided with suitable elasticity by the synergistic effect with the nonwoven fabric 1, and is very pleasant to walk on. Urethane foam (ester foam, ether foam) is used as a foam sheet 10, but ether foam is preferred in particular because of its excellent cushioning characteristics. However, the object is not limited to this, and any other foam, such as foam rubber (natural rubber, SBR) or vinyl foam, may also be used.

The present invention is described in detail below with the aid of the following concrete example.

### **Practical Example**

A scrim woven by the plain weaving of polypropylene tape yarn having a fineness of 1,000 d at a thread count of 4.7 threads/cm served as a foundation fabric, three webs comprising polypropylene having a fiber length of 38 mm and a single fiber fineness of 15 d were combined, and a felt mat having a total weight of 600 g/m<sup>2</sup> was obtained by needle-punching using a needle-punching machine to achieve a needle density of 130 n/cm<sup>2</sup>. When this felt mat was layered and bonded to a urethane foam sheet having a thickness of 3 mm, NUC polyethylene (polyethylene resin manufactured by Nippon Unicar Co.) was melted with a melting extruder at about 300°C, extruded in film form from the T-die disposed at the tip thereof, crimped together by a pressure roller introduced between the two immediately before the temperature of the film-shaped product with a weight of 200 g/m<sup>2</sup> fell to 270°C or less, and cooled. The felt mat and the urethane foam sheet were then firmly bonded together when rolled up at a speed of 13 m/minute, yielding a nonwoven carpet that exhibited a bonding strength greater than the structural strength of the urethane sheet, that had excellent cushioning characteristics, and that did not separate by a flexing test of 1,000 times or more on a universal abrasion testing machine.

The present invention, as described in detail above, is capable of inexpensively manufacturing a nonwoven carpet having excellent performance because a heated synthetic resin film is sandwiched between a needle-punched nonwoven fabric and a foam sheet, and is directly layered and bonded. Because the fluff of the nonwoven fabric melts into the heated film and a

portion of the resin comprising the film is forced into the needle holes produced by needle-punching on the nonwoven fabric surface, the bonding is very firm and does not separate. On the other hand, the two are bonded together under pressure while the foam sheet surface that makes contact with the film is kept in a viscous state, and a portion of the resin comprising the film is pressed into the exposed bubbles of the foam sheet, so the foam sheet bonding is also very firm. There is therefore no drawback whereby the nonwoven fabric and the foam sheet separate by repeatedly applied walking pressure. The inverse U-shaped leg portions created by needle-punching have nonwoven fabric fluff, but because this fluff melts into the film, an effect similar to that obtained by back-coating is obtained as an anchoring effect for the fiber in the nonwoven fabric, resulting in an excellent anchoring action. If a foam sheet is used as the lower surface of the nonwoven carpet produced by the method of the present invention, the moisture resistance and water resistance are excellent, exceptional walking performance is obtained by way of the synergistic effect of the elasticity of the needle-punched nonwoven fabric and the foam sheet, and the dimensional stability is excellent because the layers are bonded by the interposed synthetic resin. A nonwoven carpet that is pleasant to use, can be inexpensively provided, is easily cut, and does not require edge trimming can be manufactured with the method of the present invention. The undesirable edge rounding can be prevented even without edge trimming, and light weight and many other excellent effects are obtained.

## Claims

1. A manufacturing method for nonwoven carpet, characterized in that when a synthetic resin film serving as a foundation fabric is layered and pressure-bonded between a foam sheet and a nonwoven fabric formed by the needle-punching of a polypropylene fiber layer, the nonwoven fabric and the foam sheet are bonded together using as the foundation fabric a synthetic resin film heated to a temperature equal to or greater than that at which the fluff of said nonwoven fabric melts and the foam sheet exhibits viscosity.

Fig. 1

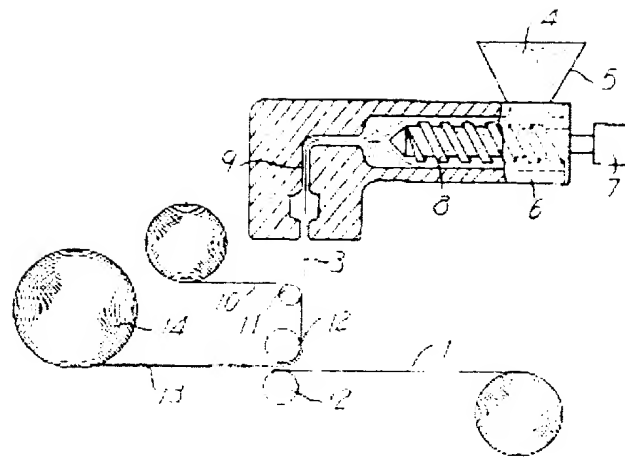


Fig. 2

